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FORCE OF GRAVITY AT ANY LATITUDE.

BY R. J. ADCOCK, MONMOUTH, ILL.

On the supposition that the earth's surface is an oblate ellipsoid of revolution, and a level surface, to determine the formula for the superficial force.

Let a = the equatorial radius, b = polar radius and r = radius at latitude l; put v = geocentric latitude; p = equatorial, and q = polar gravity, and R = gravity at the latitude l. From the geometrical relations,

$$r = \frac{ab}{(a^2\sin^2 v + b^2\cos^2 v)^{\frac{1}{2}}}, \quad \ldots\ldots\ldots\ldots \quad (1)$$

$$dr = \frac{a^3\sin^2 v\,db + b^3\cos^2 v\,da}{(a^2\sin^2 v + b^2\cos^2 v)^{\frac{3}{2}}} = \frac{[(b\div a)\tan^2 l\,db + da][1 + (b^4\div a^4)\tan^2 l]^{\frac{1}{2}}}{[1 + (b^2\div a^2)\tan^2 l]^{\frac{3}{2}}} \quad \ldots\ldots(2)$$

$$\cos(l - v) = \frac{\cos l[1 + (b^2\div a^2)\tan^2 l]}{[1 + (b^2\div a^2)\tan^2 l]^{\frac{1}{2}}}. \quad \ldots\ldots\ldots \quad (3)$$

From the principles of fluid equilibrium, R is every where perpendicular to the level surface, and is inversely proportional to the distance between. the two contiguous level surfaces at l. And it is evident that since the force R makes the exterior level surface an ellipsoid, the force $R \pm dR$, which makes the surface infinitely near this level, makes it an ellipsoid also.

Hence $$R\cos(l - v)dr = p\,da = q\,db. \quad \ldots\ldots\ldots\ldots \quad (4)$$

By elimination $$R = \frac{p[1 + (b^2\div a^2)\tan^2 l]^{\frac{1}{2}}}{\cos l[1 + (bp\div aq)\tan^2 l)}. \quad \ldots\ldots\ldots\ldots \quad (5)$$

From (5) three pendulum observations determine p, q, and $b\div a$. And the formula agrees tolerably well with the observations given on page 96 of Baily's report of Foster's experiments.

Clairaut's formula which is $R = p\{\,1 + [(q - p)\div p]\sin^2 l\,\}$ gives an excess of about $3\frac{1}{4}$ vibrations of the seconds pendulum in 24 hours at latitude 45°.

SOLUTION OF A PROBLEM.

BY W. E. K. GOUDY, A. M. SPRINGFIELD, OHIO.

Problem. I have 4 round balls, each 6 inches in diameter, and desire to have a box made of 4 equal boards each one inch thick, that will just circumscribe the balls when they touch each other. Required the square feet of boards in the box?